

WHAT IS CLAIMED IS:

1. A method for growing a thin film on a surface of a substrate in a reaction chamber according to the ALD method, said method comprising:

feeding a pulse of a first vapor phase reactant into said reaction chamber;

5 reacting the first vapor phase reactant with said surface of said substrate to form a thin film on said substrate, wherein residual first vapor phase reactant remains in said reaction chamber; and

feeding a pulse of a second vapor phase reactant into said reaction chamber, wherein said second vapor phase reactant reacts with said residual first vapor phase reactant to form a solid reaction product in said reaction chamber.

10 2. The method of Claim 1, wherein said residual first vapor phase reactant is in the gas phase.

3. The method of Claim 1, wherein said residual first vapor phase reactant is adsorbed on the walls of the reaction chamber.

15 4. The method of Claim 1, wherein said reaction chamber comprises a pre-reaction chamber and a second reaction chamber, wherein said pre-reaction chamber is upstream of said second reaction chamber.

5. The method of Claim 4, wherein said second reaction chamber is operated under conditions conducive to ALD.

20 6. The method of Claim 4, wherein said thin film is formed in said second reaction chamber.

7. The method of Claim 4, wherein said residual first vapor phase reactant is present in said pre-reaction chamber.

25 8. The method of Claim 4, wherein said reaction product is formed in said pre-reaction chamber.

9. The method of Claim 1, further comprising repeatedly alternately feeding at least said first vapor phase reactant and said second vapor phase reactant.

30 10. The method of Claim 9, further comprising contacting said first vapor phase reactant with residual second vapor phase reactant, thereby forming said reaction product.



11. The method of Claim 1, further comprising feeding a plurality of vapor phase reactants into said reactor.

12. The method of Claim 1, wherein said second vapor phase reactant reacts with said residual first vapor phase reactant under conditions conducive to chemical vapor deposition.

13. The method of Claim 4, wherein said pre-reactor is placed immediately adjacent to the said second reaction chamber and it is adapted to be freely communicating with the second reaction chamber.

14. The method of Claim 4, wherein said first vapor phase reactant is fed into said reaction chamber from a source of first vapor phase reactant through a first feed channel and said second vapor phase reactant is fed into said reaction chamber from a source of second vapor phase reactant through a second feed channel.

15. The method of Claim 14, wherein said first feed channel and said second feed channel are interconnected upstream of said second reactor to form a gas space defining said pre-reactor.

16. The method of Claim 4, wherein said pre-reactor is operated under conditions conducive to chemical vapor deposition so as to form said solid reaction product.

17. The method of Claim 4, wherein said second vapor phase reactant is reacted with the residual first vapor phase reactant to form a solid product so as to deplete the residual first vapor phase reactant, thereby preventing said residual first vapor phase reactant from entering said second reaction chamber.

18. The method of Claim 4, wherein the pre-reactor is operated at the same temperature as the second reactor.

19. The method of Claim 1, wherein the reaction product is removed from the reaction chamber separately from the thin film.

20. The method of Claim 1, wherein the reaction product is deposited on a discardable substrate.

21. The method of Claim 4, wherein the reaction product is formed on the inner walls of the pre-reactor, and the reaction product is removed from the pre-reactor by cleaning the walls.



22. The method of Claim 4, wherein a concentration of said residual first vapor phase reactant in said pre-reactor is reduced to less than 1 ppm by reacting said residual first vapor phase reactant with said second vapor phase reactant.

5 23. The method of Claim 4, wherein a concentration of said residual first vapor phase reactant in said pre-reactor is reduced to a concentration of less than 1 vol-% by reacting said residual first vapor phase reactant with said second vapor phase reactant.

24. The method of Claim 1, further comprising feeding an inactive gas into said reactor after feeding said first vapor phase reactant or said second vapor phase reactant.

10 25. The method of Claim 24, further comprising evacuating said reaction chamber while feeding said inactive gas.

26. The method of Claim 1, wherein a pressure in said reaction chamber is in the range of 1 to 100 mbar.

15 27. An apparatus for growing thin films on a substrate by subjecting the substrate to alternately repeated surface reactions of vapor phase reactants according to the ALD method, said apparatus comprising:

a pre-reactor;

a reaction chamber into which the substrate can be disposed, wherein said pre-reactor is arranged immediately upstream of said reaction chamber;

20 a plurality of inflow channels communicating with said reaction chamber, wherein said inflow channels are adapted to feeding the vapor phase reactants in the form of vapor-phase pulses into said reaction chamber; and

at least one outflow channel communicating with said reaction chamber, said outflow channel being adapted for the outflow of reaction products and excess amounts of said vapor phase reactants from said reaction chamber,

25 wherein said pre-reactor forms a first reaction zone, in which the reactants of successive vapor-phase pulses can be reacted with each other in the vapor phase to form a solid reaction product, wherein said reaction chamber forming a second reaction zone can be operated under conditions conducive to ALD growth of a thin film.

30 28. The apparatus of Claim 27, wherein the pre-reactor can be operated under conditions conducive to CVD.



29. The apparatus of Claim 27, wherein the pre-reactor is adapted to contain a substrate on which CVD grown reaction products can be deposited.

30. The apparatus of Claim 27, wherein the pre-reactor comprises a gas space interconnecting the separate inflow channels of the vapor phase reactants upstream of the reaction chamber.

31. The apparatus of Claim 27, wherein at least one of the gas feed channels is suited for feeding inactive gas into the reaction chamber.

32. The apparatus of Claim 27, wherein the pre-reactor and the reaction chamber comprise a plurality of aligned substrates.

33. The apparatus of Claim 32, wherein said plurality of aligned substrates are serially aligned in a gas flow direction of the vapor-phase pulses of the reactants.

34. The apparatus of Claim 33, wherein a first substrate forms a surface for the growth of a solid reaction product by chemical vapor deposition.